A REVIEW OF THE HARP SEAL TOTAL ALLOWABLE CATCH (TAC) FOR 2009

Context

Harp seals, *Pagophilus groenlandicus*, are the most abundant pinniped in the northwest Atlantic with an estimated total population size in 2005 of 5.8 million (95% CI= 4.1-7.6 million) (Hammill and Stenson 2005). Since 2003, the Canadian commercial harp seal harvest has been managed under an Objective Based Fisheries Management (OBFM) approach which incorporates the principle of the Precautionary Approach. Under this approach, precautionary reference levels are identified and are associated with pre-agreed management actions that are to be enacted if the population is estimated to decline further (DFO 2003). Under OBFM, the management objective is to set harvests that will ensure an 80% probability (L20) that the population will remain above the precautionary reference level (N70) of 4.1 million animals. The limit reference level for this population, also known as a conservation reference level, has been set at N30 or 1.7 million animals. In evaluating the impacts of different harvest levels on the population, reported harvests by Canadian and Greenland hunters, losses due to animals struck but not landed or reported, bycatch in fishing gear, changes in reproductive rates, and unusual mortality due to poor ice conditions are taken into account (Hammill and Stenson 2005).

Background

At the National Marine Mammal Peer Review meeting held in November 2008, the impact of several different harvest scenarios on the harp seal population were examined to determine if they respected the objectives of the current management plan which ends after the 2010 hunt (Table 1).These runs indicated that scenarios with a 2009 harvest of 300,000 animals (300k) did not respect the management plan, resulting in the population falling below N_{70} after the 2009 harvest had been completed. Harvests of 270,000 and 250,000 could be carried out in 2009 and would allow the population to remain above N_{70} after the 2009 hunt, but would result in L20 falling below the precautionary level (N70) after the 2010 hunt. A harvest of 270,000 animals in 2009 may require a substantial reduction to less than 175,000 animals in 2010 to respect the management plan. A harvest of 250,000 animals in 2009 would require reducing the TAC to 225,000 animals in 2010 to respect the plan.

Table 1. Harp seal harvest scenarios examined during the National Marine Mammal Peer Review Committee meeting in November 2008.

Scenario	2009	2010	2011
A	270,000	270,000	270,000
B	300,000	250,000	170,000
C	200,000	200,000	200,000
D	300,000	300,000	300,000
E	250,000	250,000	250,000

An annual harvest of 200,000 could be carried out in both 2009 and 2010 and still respect the management objective (DFO 2008). Subsequent to this meeting, Science was asked to provide supplementary advice to determine the impact of a Total Allowable Catch (TAC) of 280,000 animals in 2009 on the harp seal population and whether this TAC respects the 2006-2010 management plan objectives.

Analysis and responses

The impact of a 2009 catch of 280,000 animals on the Northwest Atlantic harp seal population was assessed using the same model and parameters as used during the previous runs and described in Hammill and Stenson (2008). This model uses data on pup productions up to 2004 and catches to 2008. The basic model was reviewed by the National Marine Mammal Peer Review Committee in 2005 (DFO 2005).

Each of the projections was run assuming that the level of subsistence catch in the Canadian Arctic, bycatch in fishing gear and the age structure of the harvest remained unchanged. The age composition of the Canadian commercial catch was changed from 90% young of year (YOY) to 95% YOY to reflect the structure observed in the catch (Stenson 2008).

We assumed that extra mortality related to poor ice conditions in 2009 and future years could be described by a uniform distribution with a mean value of 12% but varies equally between 0 and 30% (0, 0.1, 0.20, 0.30, 0). The values in the uniform distribution were assigned randomly for additional mortality in each year of the projections and this mortality occurs before the hunt begins.

An additional source of uncertainty relates to reported harvest rates in Greenland. The Greenland harvest has varied greatly in recent years with reported harvests ranging from as low as 70,000 in 2004 to approximately 100,000 in 2000. The Greenland harvest is not limited by quota; therefore we entered the Greenland harvest into the model as a uniform function with a range of 70,000 to 100,000 for a mean harvest of 85,000 animals.

The model run assumed a harvest of 280,000 in 2009 and then adjusted the harvest for 2010 to a level that would still allow the management plan to be respected. If the assumptions surrounding the model are correct (reproductive rates have not changed, catches and ice related mortality are known or reasonably approximated by the model) then a 2009 catch of 280,000 animals would respect the current objectives of the management plan. However, a substantial reduction in the TAC to 125,000 animals would be needed to respect the objectives of the management plan in its final year (Fig. 1).

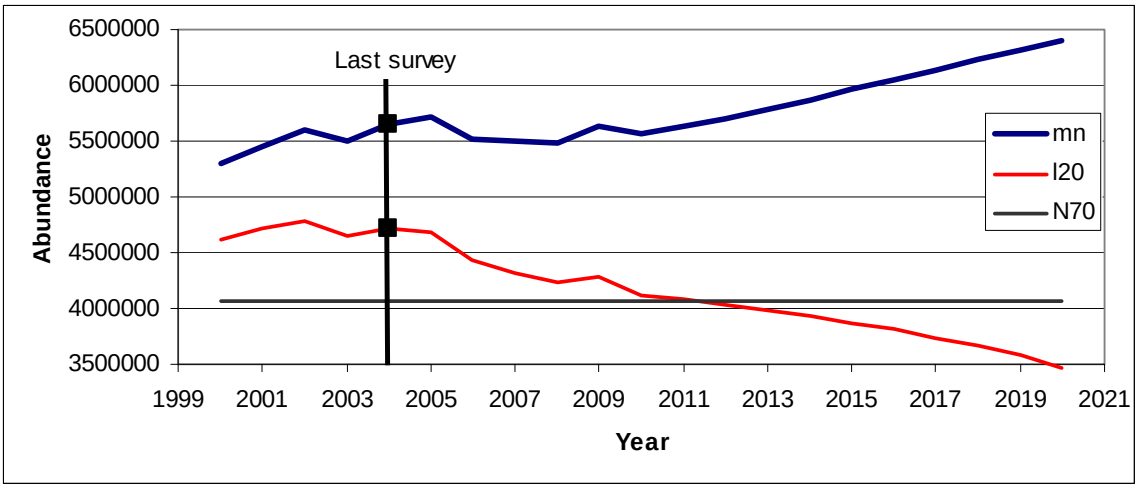

Figure 1. Modeled population trajectory of the Northwest Atlantic harp seal with a 2009 TAC of 280,000 animals followed by annual harvests of 125,000 seals. The upper line represents the mean population size (mn) and the lower line represents the L20 population. For the mean population line there is a 50% chance that the population is greater than this and a 50% chance that the population is smaller than this. For the L20 line there is and 80% chance that the population is greater than this and a 20% chance that the population is smaller than this. The vertical line identifies when the last survey was completed.

Conclusions

One of the primary considerations in the development of the Objective Based Fisheries Management (OBFM) approach to the management of Atlantic seals was to take into account our uncertainty about the population and to maintain some buffer in the event of unusual or unexpected events. Use of the L20 is predicated upon the idea that on 8 out of 10 occasions the population is actually higher than the stated level, or conversely, the population would only be lower than L20 levels on 2 out of 10 occasions. As predictions are made further into the future, our uncertainty increases and this is captured by the increasing divergence between the mean and the L20 population levels. This characteristic reflects the fact that attempting to predict the impacts of different TAC levels on a population 5 years after the last assessment was conducted is highly uncertain. This is particularly true for harp seals because the fishery removes primarily juveniles and the assessments are only completed every 4-5 years. As a result, the impact of this removal will not be measurable for at least five years.

The impacts of a TAC of 280,000 animals on the harp seal population were evaluated using information from a population model fitted to aerial survey and reproductive rate data from the 2004 assessment, but with updated information on catches, age structure of the catch and judgments on recent environmental conditions. A catch of 280,000 animals in 2009 would continue to respect the management plan only if the TAC is reduced to 125,000 animals in 2010, which will also be the last year of the current management plan. However, there is considerable uncertainty associated with this analysis.

A new assessment incorporating more recent survey and reproductive rate information will reduce the uncertainty surrounding current estimates of the population significantly. A survey was completed in 2008, and results are expected prior to the next harvest.

Contributors

Mike Hammill (co-author)	DFO, Science, Quebec Region
Garry Stenson (co-author)	DFO, Science, Newfoundland Region
Don Bowen	DFO, Science, Maritime Region
Peter Olesiuk	DFO, Science, Pacific Region
Jack Lawson	DFO, Science, Newfoundland Region
Dave Gillis	DFO, Science, National Capital Region
Christine Abraham	DFO, Science, National Capital Region
Ghislain Chouinard	DFO, CSAS, National Capital Region
Atef Mansour	DFO, CSAS, National Capital Region

Approved by

Serge Gosselin
A/Regional Director, Science
Mont-Joli, QC

Date : 8 may 2009

Jay Parsons
A/Regional Director, Science
St. John's, TN

Date : 8 may 2009

Sources of information

DFO. 2005. Proceedings of the meetings conducted by the National Marine Mammal Peer Review Committee from February to May 2005. DFO Can. Sci. Advis. Sec. Proceed. Ser. 2005/001.

DFO. 2008. Science advice on harvesting of northwest Atlantic harp seals (*Pagophilus groenlandicus*) in 2009. DFO Sci. Advis. Rep. 2008/058.

Hammill, M.O. and G, B, Stenson. 2008. Abundance of Northwest Atlantic harp seals (1960-2008) DFO Can. Sci. Advis. Sec. Res. Doc. 2008/077.

Stenson, G. B. 2009. Recent catches of harp seals (*Pagophilus groenlandicus*) in the Northwest Atlantic. DFO Can. Sci. Advis. Sec. Res. Doc. 2008/080.

This Report is Available from the:

Center for Science Advice (CSA)
Quebec Region
Fisheries and Oceans Canada
Maurice Lamontagne Institute
P.O. Box 1000, Mont-Joli
Quebec (Canada)
G5H 3Z4

Telephone: (418) 775-0825
Fax: (418) 775-0679
E-Mail: Bras@dfo-mpo.gc.ca
Internet address: www.dfo-mpo.gc.ca/csas

ISSN 1919-3750 (Print)
ISSN 1919-3769 (Online)

La version française est disponible à l'adresse ci-dessus.

Correct Citation for this Publication:

DFO. 2009. A Review of the Harp Seal Total Allowable Catch (TAC) for 2009. DFO Can. Sci. Advis. Sec. Sci. Resp. 2009/006.